CLAIMS

1. A power transmission system having an input member (6) and an output member (2) for transmitting power, and an oil pump (7) for discharging oil by a relative rotation between a first rotary member (8, 70) and a second rotary member (9, 87, 88), which is driven by the power transmitted between the input member (6) and the output member (2), characterized in that:

the input member (6) and the first rotary member (8, 70) are connected with each other in a power transmittable manner, and the output member (2) and the second rotary member (9, 87, 88) are connected with each other in a power transmittable manner; and

characterized by comprising:

a transmission member (11, 13, 76, 77) for connecting the first rotary member (8, 70) and the second rotary member (9, 87, 88) in a power transmittable manner; and

a control valve (27, 110) for controlling a power transmission state between the first rotary member (8, 70) and the second rotary member (9, 87, 88), by controlling an oil discharge condition of the oil pump (7).

2. The power transmission system as claimed in Claim 1, characterized in that:

the oil pump (7) is a radial piston pump comprising a piston (11, 76) which is arranged in any one of the first rotary member (8, 70) and the second rotary member (9, 87, 88), and which acts radially in a direction perpendicular to a rotation axis of the first rotary member (8, 70) and the

second rotary member (9, 87, 88).

3. The power transmission system as claimed in Claim 1 or 2, characterized by further comprising:

a control means (53) for controlling the discharge condition of the oil pump (7) by controlling the control valve (27, 110) on the basis of the operating condition of a vehicle (Ve).

4. The power transmission system as claimed in Claim 3, characterized in that:

the transmission member (11, 13, 76, 77) is constructed to increase the torque transmitted between the first rotary member (8, 70) and the second rotary member (9, 87, 88) in accordance with a reduction of the discharge amount of the oil pump (7), or a rise in a discharge pressure of the oil pump (7); and

the control means (53) comprises a means for controlling the control valve (27, 110) so that the discharge amount of the oil pump (7) is reduced, or so that the discharge pressure of the oil pump (7) is raised, according to the increase in a target value of the torque transmitted between the input member (6) and the output member (2).

5. The power transmission system as claimed in Claim 3, characterized in that:

the control means (53) comprises a means for controlling the control valve (27, 110) so that the discharge amount or the discharge pressure of the oil pump (7) is adjusted to the target value of the speed difference between

the first rotary member (8, 70) and the second rotary member (9, 87, 88); and

the target value of the speed difference between the first rotary member (8, 70) and the second rotary member (9, 87, 88) is determined,

by determining a target value of the torque transmitted between the first rotary member (8, 70) and the second rotary member (9, 87, 88) so that the vibration and noise resulting from a fluctuation of the torque transmitted from the input member (6) to the output member (2) is suppressed within a permissible value, and

by determining a target speed difference between the first rotary member (8, 70) and the second rotary member (9, 87, 88) on the basis of the determined target value of the torque.

6. The power transmission system as claimed in Claim 3, characterized in that:

the control means (53) comprises a means for controlling the control valve (27, 110) so that the discharge amount or the discharge pressure of the oil pump (7) is adjusted in accordance with the fluctuation of the torque transmitted from the input member (6) to the output member (2).

7. The power transmission system as claimed in any of Claims 1 to 6, characterized by comprising:

a planetary gear mechanism (PR) having three rotary elements (39, 40, 43) capable of rotating differentially;

whereas the second rotary member (87, 88) comprises a first construction member (87) and a second construction member (88), which are

connected individually with the two rotary elements (39, 43) of the planetary gear mechanism (PR), and

whereas the first construction member (87) and the second construction member (88) are arranged coaxially in a predetermined direction; and

a coupling mechanism (71, 86) for connecting the first rotary member (70) selectively with the first construction member (87) or the second construction member (88) in a torque transmittable manner, by moving the transmission member (76, 77) in a predetermined direction.

8. The power transmission system as claimed in Claim 7, characterized in that:

the oil pump (7) is a radial piston pump comprising a piston (76) which is arranged in the first rotary member (70), and which acts radially in a direction perpendicular to the rotation axis of the first rotary member (70) and the second rotary member (87, 88);

the piston (76) is equipped with the transmission member (77);

the first construction member (87) and the second construction member (88) are provided individually with a cam (36) to which the transmission member (77) is contacted;

the cam (36) of the first construction member (87) and the cam (36) of the second construction member (88) are arranged coaxially in a predetermined direction; and

characterized by comprising:

a smoothing mechanism (89, 90, 91, 92) for smoothing a movement of the transmission member (77) between the cam (36) of the first

construction member (87) and the cam (36) of the second construction member (88).

9. The power transmission system as claimed in Claim 7 or 8, characterized in that:

the planetary gear mechanism (PR) is a double-pinion type planetary gear mechanism, which comprises,

a sun gear (39) as the first rotary element,

a ring gear (40) as the second rotary element, and

a carrier (43) as the third rotary element for holding a first pinion gear (41) meshing with the sun gear (39) and a second pinion gear (42) meshing with the first pinion gear (41),

whereas the first construction member (87) is connected with the sun gear (39), and the second construction member (88) is connected with the carrier (43); and

characterized by comprising:

a brake (94) for allowing the ring gear (40) to rotate, in case the transmission member (76, 77) and the first construction member (87) are connected with each other in a power transmittable manner.

10. The power transmission system as claimed in any of Claims 1 to 9, characterized by comprising:

a transmission (TM) to which the power of the output member (2) of the oil pump (7) is transmitted.

11. The power transmission system as claimed in Claim 10,

characterized by comprising:

a hydraulic control unit (26) for controlling the transmission (TM).

12. The power transmission system as claimed in Claim 11, characterized in that:

the transmission (TM) comprises a hydraulic servo mechanism (49, 50), and

the oil pressure or the flow amount of an operating oil to be fed to the hydraulic servo mechanism (49, 50) is controlled by the hydraulic control unit (26).

13. The power transmission system as claimed in any of Claims 10 to 12, characterized in that:

the output member (2) functions also as an input shaft (2) of the transmission (TM).

14. The power transmission system as claimed in any of Claims 1 to 9, or any of Claims 10 to 13, characterized:

by comprising a prime mover (1) for generating driving force to run the vehicle (Ve), and

in that the power of the prime mover (1) is transmitted to the input member (6).

15. The power transmission system as claimed in Claim 14, characterized in that:

the prime mover (1) is an engine (1); and

the input member (6) is a crankshaft (6) of the engine (1).

16. The power transmission system as claimed in any of Claims 1 to 9, or Claim 10, or any of Claims 13 to 15, characterized by comprising:

a hydraulic control unit (26) to which the operating oil is fed.

17. The power transmission system as claimed in Claim 11 or 12 or 16, characterized by comprising:

a hydraulic control unit (26) to which the operating oil discharged from the oil pump (7) is fed.

18. The power transmission system as claimed in any of Claims 1 to 17, characterized in that:

the power of the prime mover (1) for generating a driving force to run the vehicle (Ve) is transmitted to a wheel (5) through the oil pump (7), the transmission (TM) and a deferential (4).

19. The power transmission system as claimed in Claim 10 or 11 or 12 or 13 or 18, characterized in that:

the transmission (TM) comprises a forward/backward switching mechanism (37), and a continuously variable transmission (3).

20. The power transmission system as claimed in Claim 2, characterized in that:

the power of the prime mover (1) is transmitted to the second rotary member (9, 87, 88) through the first rotary member (8, 70);

the piston (11, 76) is arranged in the first rotary member (8, 70);

the cum (36) is arranged in a circumferential direction of the second rotary member (9, 87, 88); and

the piston (11, 76) moves radially in consequence of its rotational transfer in the circumferential direction of the cum (36) resulting from the relative rotation between the first rotary member (8, 70) and the second rotary member (9, 87, 88).

21. The power transmission system as claimed in any of Claims 1 to 6, characterized in that:

the control valve (27) comprises a spool (28) the action of which is controlled by energizing a solenoid (30), and a port (C1) connected with an oil discharging passage (19) of the oil pump (7); and

the section area of the port (C1) is controlled by the action of the spool (28) thereby controlling the oil discharge amount of the oil pump (7).

22. The power transmission system as claimed in Claim 3, characterized:

by comprising a prime mover (1) for generating a driving force to run the vehicle (Ve),

in that the power of the prime mover (1) is transmitted from the input member (6) to the output member (2),

in that the control valve (27) comprises a port (C1) connected with an oil discharging passage (19) of the oil pump (7); and

in that the control means (53) comprises a means for controlling the section area of the port (C1) of the control valve (27) on the basis of a result

of a comparison between an actual speed and a target speed of the prime mover (1).

23. The power transmission system as claimed in Claim 3, characterized:

by comprising an oil requiring portion (44A, 45A, 49A, 50A, 300) to which the oil discharged from the oil pump (7) is fed; and

in that the control valve (27) comprises a port (C1) connected with an oil discharging passage (19) of the oil pump (7); and

in that the control means comprises a means for controlling the section area of the port (C1) of the control valve (27) on the basis of a result of a determination of the oil pressure and the feeding amount required in the oil requiring portion (44A, 45A, 49A, 50A, 300).

24. The power transmission system as claimed in Claim 3, characterized in that:

the control valve (27) comprises a port (C1) connected with an oil discharging passage (19) of the oil pump (7); and

the control means (53) comprises a means for controlling the section area of the port (C1) of the control valve (27) on the basis of a result of a determination of a speed difference between the first rotary member (8, 70) and the second rotary member (9, 87, 88).

25. The power transmission system according to Claim 16 or 17, characterized in that:

the oil discharged from the oil pump (7) to the oil discharging

passage (19) is fed to the hydraulic control unit (26) through the control valve (110); and

the control valve (110) comprises,

a port (D1) connected with an oil discharging passage (19),

a spool (111) for controlling the section area of the port (D1), which is reciprocatable in an axial direction,

an elastic member (112) for applying an elastic force to the spool (111) in the axial direction,

a control port (115), to which a control oil pressure regulated by the hydraulic control unit (26) is inputted, and which applies a force to the spool (111) in a same direction as the force applied by the elastic member (112), and

a feedback port (116), which is connected with the oil discharging passage (19) of the oil pump (7), and to which the oil pressure for applying a force to the spool (111) in a direction opposite to the force applied to the spool (111) by the elastic member (112) is inputted.

26. The power transmission system according to Claim 25, characterized in that:

the control means (53) comprises a means for controlling a discharge pressure of the oil pump (7) on the basis of a result of comparison between an actual speed and a target speed of the prime mover (1).

27. The power transmission system according to Claim 25, characterized:

by comprising an oil requiring portion (44A, 45A, 49A, 50A, 300) to

which the oil discharged from the oil pump (7) is fed; and

in that the control means (53) comprises a means for controlling the discharge pressure of the oil pump (7) by controlling the control valve (110) on the basis of a result of a determination of the required oil pressure and the required feeding amount of the oil in the oil requiring portion (44A, 45A, 49A, 50A, 300).

28. The power transmission system according to Claim 25, characterized in that:

the control means (53) comprises a means for controlling the discharge pressure of the oil pump (7) by controlling the control valve (110) on the basis of a result of determination of a speed difference between the first rotary member (8, 70) and the second rotary member (9, 87, 88).